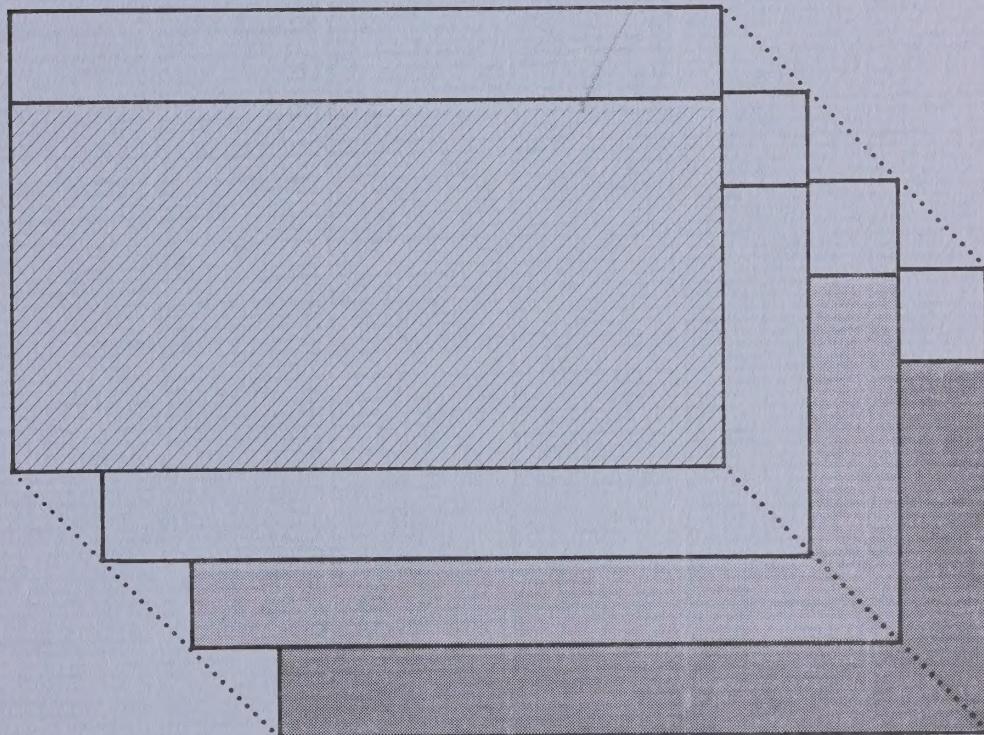


ENVIRONMENTAL
MANAGEMENT
PLAN
FOR THE
SAN FRANCISCO
BAY REGION

D R A F T

Water Supply Management Plan



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ENVIRONMENTAL MANAGEMENT PLAN
FOR THE
SAN FRANCISCO BAY REGION

DRAFT WATER SUPPLY MANAGEMENT PLAN

OCTOBER 24, 1977



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Chapter—1

Purpose of document

This document is one of twelve draft management plans prepared as part of the Environmental Management Program for the San Francisco Bay Region. The draft management plans which will be published during September and October, 1977, are as follows:

- o Air Quality Maintenance Plan
- o Water Quality Management Plan
- o 8 County-wide Surface Runoff Control Plans
- o Water Supply Management Plan
- o Solid Waste Management

At this stage the plans are not in final form. The draft plans are intended to stimulate public discussion of environmental quality in the Bay Region. Comments received will be used to assist in preparing the final, integrated Environmental Management Plan (EMP).

The purpose of this document is to describe a plan for supplying water to the Bay Area for the next twenty years--at a minimum monetary and environmental cost. The current drought has affected the nature and content of the plan. The quantities of water that existing and planned facilities can reliably deliver appear to be less than previously thought. Exactly how much less will not be known until the drought is over. For this reason the plan recommendations will need to be updated once the full extent of the drought is known.

Extensive technical analyses were undertaken during the development of this plan. A full report on these analyses will be contained in the final EMP.

ABAG gratefully acknowledges J.B. Gilbert and Associates, on whose detailed, comprehensive study of water conservation, reuse and supply much of this plan is based. That study is available on request. It should be emphasized, however, that the conclusions in this plan are ABAG's.

Chapter—2

Summary description of the plan

The existing arrangements for supplying water to the Bay Area have been notably successful. Until this year few activities in the region have been limited by lack of water. Water supplies have rarely been rationed and then only for brief periods. Why, then, do we need to develop a water supply plan? It is because circumstances are changing; we will need more water in the future but there is a growing reluctance on the part of many people to accept the costs and environmental consequences of the large landscape-altering projects necessary to deliver it.

Although the Bay region is water-short, in that it uses more water than can be captured in the regional watershed, abundant water can be had from more remote sources. By the 1920's local sources of water were inadequate to supply the growing urban area. To supplement supplies the Hetch-Hetchy and Mokelumne systems were built to bring water to the region from the Sierra Nevada. At the time the water was diverted it was regarded as "surplus" water. If it hadn't been diverted it would simply have flowed out of the delta to be wasted in the ocean. However, the concept of "surplus" water was never a sound one. Diversion of water for one purpose inevitably makes it unavailable for another. No water is truly surplus; it is just that society considers some uses to be more important or valuable than others.

Recent years have seen a shift in cultural values. Water uses once thought to be of no value are prized by many people. The desire to store water and convey it to the cities is in conflict with the desire to maintain flows in rivers, streams and the Sacramento-San Joaquin Delta. These flows are necessary for recreation and wildlife preservation as well as municipal and agricultural uses. When the water diverted was "surplus" water there was little reason to avoid waste. Now that it is recognized that five gallons of water wasted flushing a cigarette butt down the toilet multiplied millions of times means that more desirable uses of water will be foregone, a re-examination is necessary.

Thus, we are faced with a dilemma. How can we obtain water to satisfy some of our needs without impairing or eliminating other uses of water? The answer is to use the water available to us efficiently and without waste. This plan represents a step toward that goal.

In 1975, before the drought, the region used 1580 million gallons per day (mgd) of water. About 40 percent of this water was used for agriculture, the remainder being used in homes and businesses. By the year 2000 the demand for water is expected to rise 23 percent to 1940 mgd if we continue to use water in the same way as we did before the drought. The drought, however, is causing uncertainties in water planning. Before the drought it was assumed that as population increased the region

would use more water. Now we are not so sure. No one could have predicted the tremendous reduction in water use brought about by the drought and conservation practices. And for most of the region, using less water has not caused much personal hardship. Will water saving become a permanent feature in the Bay Area? No one knows.

There are three ways we can match our future demand for water with our future supply: we can use less--water saving, we can use water twice--wastewater reclamation and reuse, and we can develop new sources. Each of these alternatives has certain advantages and disadvantages.

The least expensive way to match supply and demand is to save water. But water saving alone cannot reduce demand by more than about 12 percent without probably unacceptable changes in lifestyle. However, water saving has built up considerable momentum as a result of the drought. Many of the major water suppliers have developed innovative and demonstrably successful water savings programs. If the momentum can be maintained once the drought is over there is no doubt that water saving could play a major role in matching supply and demand.

Wastewater reclamation and reuse can be expected to supply about 6 percent of the region's water needs by the year 2000. Further use of reclaimed water is prevented by high cost, health-related limitations on its use and lack of markets close to wastewater treatment facilities.

Development of new sources of water tends to be costly and environmentally damaging. All the closer and more easily obtainable sources of water have been developed. Those that remain are far from the urban centers. Long and costly pipelines are needed to bring water into the region from these sources.

Two other factors affect the efficiency of water use in the region. Water is supplied to consumers by 83 separate agencies from eight separate sources. Each major agency operates fairly independently, securing its own sources. It is probable that this leads to the development of more separate sources than would be the case if responsibility for water were less diffuse. This inefficiency is compounded by the lack of connections between water systems. If there were more ties between systems it is likely that the water available to the region could be distributed more evenly to consumers. Interties between systems would make our water supply systems more flexible; somewhat in the manner of our electrical power grid where power can be readily conveyed from any source to any consumer. In response to the drought several interties have been created; the most notable being the pipe across the Richmond-San Rafael Bridge which conveys water from the East Bay to Marin County.

A second possible inefficiency stems from the fact that water supply systems are planned to supply unrestricted water during droughts. As a consequence many of our water supply facilities are underused during wet or even normal years. As the drought has demonstrated we can cut water use substantially without great hardship. Perhaps occasional water rationing is tolerable and could be an ongoing feature of water supply planning if it would cut the cost and reduce the adverse environmental effects of developing new sources.

This plan does not attempt to resolve the water supply dilemma for all time. What it does is to provide a sense of direction which will, in the long-term, lead to more efficient use of water. The general philosophy underlying the plan is as follows. We should take steps immediately to save or reuse our existing supplies wherever this can be done at a cost (economic, environmental and social) lower or equal to the cost of new supplies. In addition we should establish a mechanism for determining what steps are necessary in the future to ensure efficient water use.

Central to the plan recommendations is the formation of a water management coordinating committee (WMCC). The committee will include representatives of all the major water and wastewater agencies. The committee will provide a forum for discussion and perhaps resolution of issues relating to long-term water supply planning, interagency transfers of water, water conservation, wastewater reclamation and drought contingency planning. The WMCC will undertake studies of common interest to members. In this way it is to be hoped the benefits of cooperative water supply planning can be obtained without costly, time-consuming and probably controversial institutional changes.

The cheapest water is water saved. The plan recommends the establishment or continuation of water savings programs emphasizing the building-in of water saving devices in new construction. City and county building codes must be modified accordingly. Retrofit of water conservation devices in existing construction should be encouraged by tax incentives as should the trend toward more efficient agricultural irrigation.

Two million dollars have been allocated by the State Water Resources Control Board for a regional study of wastewater reclamation and reuse. It is recommended that this study proceed immediately. Funding priority should be given to those reclamation and reuse projects which reduce the regional demand for high quality water by substituting reclaimed wastewater where appropriate.

Chapter—3

Present water use and supply arrangements

This section describes how water is used in the Bay region and from whence it comes.

WATER USE

In 1975, the last year of record before the drought, 1580 million gallons per day (mgd) of water was used in the region. About 40 percent of this water was used for crop irrigation mostly in the northern counties. A further 40 percent was used in private homes and by public institutions, such as hospitals. The remaining 20 percent was used by industry and commerce. In the region municipal water use averaged 199 gallons per capita per day (gpcd) varying from a low rate of 145 gpcd in Sonoma County to a high rate of 271 gpcd in Contra Costa County. Present water use by county is shown in Table 1.

WATER SUPPLY FACILITIES

In the early stages of development in the Bay Area, communities relied upon local surface water and groundwater for their supplies. When these sources became inadequate to meet the needs of a rapidly growing population other more remote sources were developed. At the present time about one-third of the regions' water comes from local surface and groundwater. Another one-third comes from surface water sources, the Sacramento-San Joaquin Delta, Lake Berryessa and Russian River, near the boundaries of the region. The last one-third comes from the western slope of the Sierra Nevada.

Water is supplied to the region from eight separate sources or systems. Figure 1 shows how supplies are brought into the region. Table 2 shows the quantities obtained from each source in 1975.

The Hetch-Hetchy system, built and operated by the City and County of San Francisco, consists of three reservoirs on the Tuolumne River watershed--Hetch-Hetchy, Lake Eleanor, and Lake Lloyd--and the Hetch-Hetchy Aqueduct, which extends about 135 miles from the Tuolumne River to Crystal Springs Reservoir located in San Mateo County.

The Mokelumne system, built and operated by the East Bay Municipal Utility District, consists of Pardee Reservoir and Camanche Reservoir, developed on the Mokelumne River, and the Mokelumne Aqueduct, which transports water to terminal reservoirs in western Contra Costa County and Alameda County.

The South Bay Aqueduct, a system of the State Water Project, diverts water from the California Aqueduct near Tracy and delivers water as far west as San Jose.

Table 1.
Water use by county in 1975
(million gallons/day)

COUNTY	Inside Resid.	Outside Resid.	Comm'l Ind'l.	Public Authority	Unacc'td For	Non-Agric.	Agric.	County Total
Alameda	81	30	62	7	16	196	18	214
Contra Costa	44	25	67	6	10	152	109	261
Marin	15	12	4	2	3	36	2	38
Napa	5	4	5	1	2	17	19	36
San Francisco	31	4	50	9	5	99	0	99
San Mateo	44	22	25	4	3	98	7	105
Santa Clara	99	43	77	24	17	260	99	359
Solano	14	7	14	6	2	43	332	375
Sonoma	<u>14</u>	<u>8</u>	<u>8</u>	<u>2</u>	<u>2</u>	<u>34</u>	<u>59</u>	<u>93</u>
REGION	347	155	312	61	60	935	645	1,580

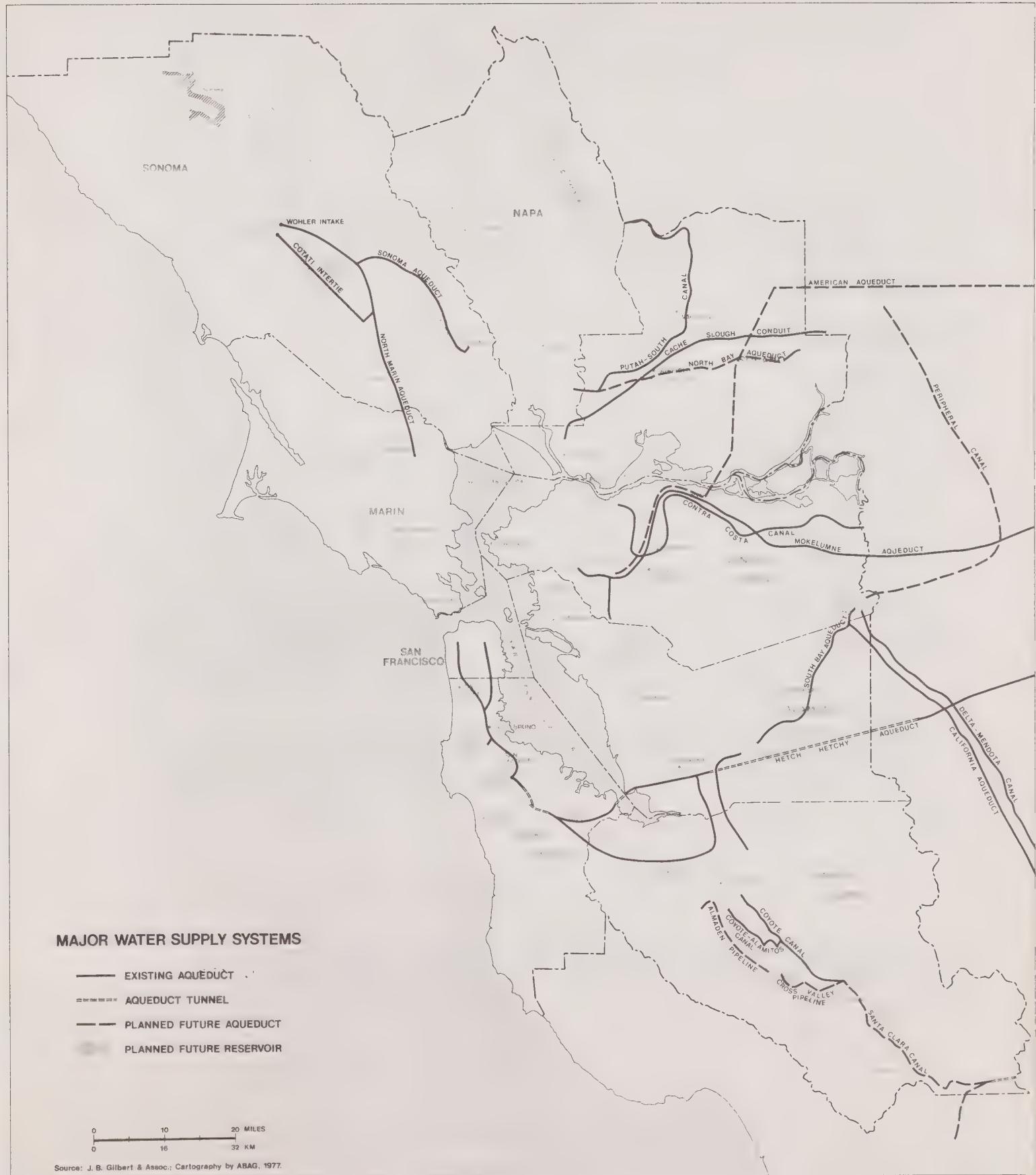


Figure 1.

Table 2.
Sources of water in 1975*

SOURCE	AMOUNT (Million gallons/day)
Sierra Mountains	460
Sacramento-San Joaquin Delta	325
Russian River	52
Lake Berryessa	199
Other Local Reservoirs	108
Santa Clara County	35
Marin County	28
Napa County	17
Alameda & Contra Costa Counties	20
Other Counties	8
Groundwater ..	436
Santa Clara County	178
Alameda County	51
Solano County	131
Sonoma County	48
Other Counties	28
TOTAL	1,580

*This table does not necessarily show safe yields from each source. It shows amounts actually used in 1975, some of which differ from the safe yield.

The Russian River system, built and operated by the Sonoma County Water Agency, consists of diversion structures located near Guerneville and aqueducts leading to the City of Santa Rosa, the Sonoma Valley, City of Petaluma, and northern Marin County.

Lake Berryessa, located in northeastern Napa County, is part of the Solano Project, which was developed and is operated by the United States Bureau of Reclamation.

The Contra Costa Canal, operated by the Contra Costa County Water District, delivers water to that county.

Local groundwater is an important water source in Alameda, Santa Clara, Solano and Sonoma Counties.

In-county surface water sources supply significant quantities of water in Marin, Napa, Santa Clara and Sonoma Counties.

Institutional Arrangements for Water Supply

Water is supplied to consumers by 83 separate water distribution or retailing agencies. In some cases, San Francisco Water Department and East Bay Municipal Utility District, for example, the same agency owns and operates a major water delivery system and retails water. More commonly a distribution agency buys water from a wholesaler such as the Santa Clara Valley Water District.

The largest water retailer in the area is East Bay Municipal Water District which serves 340 mgd to a little over a million consumers. The City of San Francisco and San Jose Waterworks each serve between 600,000 and 700,000 customers. Thirty-four of the agencies serve less than 10,000 customers.

About half the water distribution agencies are cities, 19 are special districts and 22 are private companies. The operations of the private companies are regulated by the State Public Utilities Commission.

Chapter—4

Water supply problems and possible solutions

To refer to the water supply situation as a problem is in some ways a misnomer. Until this year few activities in the region have been limited by lack of water. Water supplies have rarely been rationed and then only for brief periods. Perhaps a better term would be the water supply dilemma.

The dilemma is how to reconcile our need for water with concerns about the environmental effects of developing new water supplies. The situation is complicated by the fact that we are faced with a drought that is prompting a reexamination of the fundamentals of water supply planning. Three factors affect the dilemma: the growing demand for water, the traditional approach to water supply planning and the way the water supply industry is organized. Each of these is discussed below.

WATER DEMAND

Estimates of future water demand were made based on ABAG's Series 3 population, and land use and employment projections. Two population projections were made using different assumptions about fertility and migration. The higher of the two projections, which envisages a regional population of 6.1 million in the year 2000 as compared to 4.9 million in 1975, was used to estimate future water demand.*

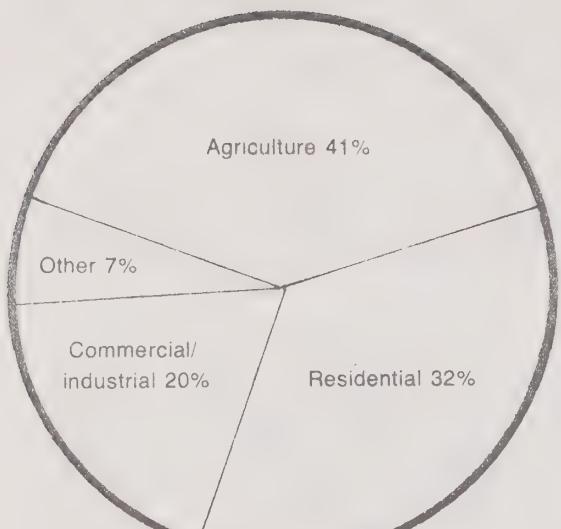
The demand for water is expected to rise from its 1975 value of 1580 mgd to 1954 mgd by 2000. Figure 2 shows what the Bay Area uses its water for, now and in the future. At present, two-fifths of the water supplied to the Bay Area is used for agriculture, mostly in the northern counties. Agriculture's share is expected to drop to less than one-third of the total in 2000 as farm land is used for new homes and businesses. On the other hand residential demand will rise from about one-third of the total at present to a little over two-fifths in 2000. Commercial and industrial water use will remain fairly constant for the next twenty-five years.

Water use per individual is expected to rise from the present 199 gallons per capita per day to 235 gpcd in 2000. The rate of water use inside the house will remain constant; the rise in residential water use is attributable to increased outside use. The trend in housing is toward lower density living with a consequent increased demand for landscape irrigation water.

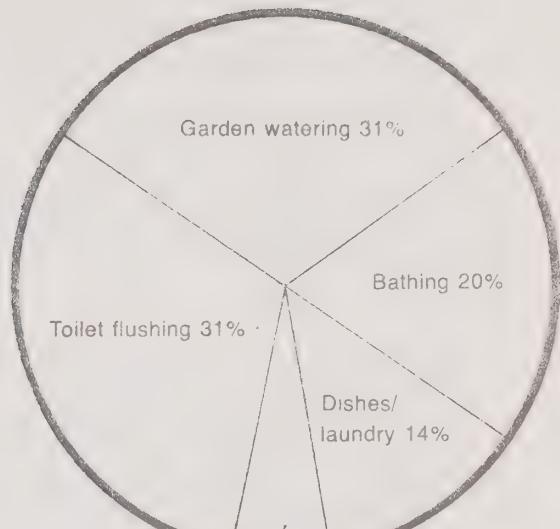
*The effect of using a lower projection is discussed in the section, "Matching Supply and Demand."

Figure 2.

Bay Area water use



1580 mgd

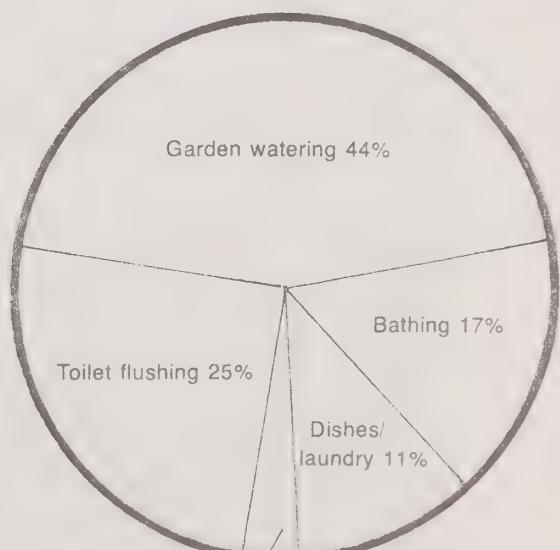


199 gal per cap/day

1975



1954 mgd



235 gal per cap/day

2000

There are a number of ways to satisfy the demand for water. We can reduce demand by saving water; we can reclaim and reuse wastewater and we can develop previously untapped water sources. Determining what mix of these options will supply the region with water at a minimum monetary and environmental cost is at the heart of the water supply dilemma. Each of the options is explored in detail in the following chapter.

WATER SUPPLY PLANNING

The planning of most engineering works that are affected by unpredictable natural phenomena is based on a calculated risk. This is perhaps best illustrated by considering the design of a hypothetical flood control project.

A small town is situated on the bank of a large river. After a severe flood causing both loss of life and extensive property damage a decision is made to build a levee to protect the town in the future. The fifty years of streamflow records available are analyzed to determine what flood height might be expected. Scientific techniques are used to extend the period of record. The height of the flood that will occur once in fifty years is calculated. Similarly, flood heights that will occur every one hundred and every one thousand years are calculated. A ten-foot levee will protect the town from the flood that occurs once in fifty years. The levee must be twelve-feet high if it is not to be topped by the once in one hundred year flood. A fifteen-foot levee will protect against the once in one thousand year flood.

The higher the levee the more expensive it will be to build. A difficult decision must be made. A low levee will be relatively inexpensive but town residents will have to live with the fact that once in fifty years the town will be flooded. The high levee almost guarantees flood protection but will exhaust the city's funds. A calculated risk is taken. The city will build a twelve-foot levee and live with the consequences of a once in one hundred year flood.

The analysis described above is typical for many different engineering projects; high-rise buildings are designed to withstand an earthquake or hurricane that occurs once in one hundred years, offshore oil drilling platforms are built to survive the impact of a wave that might occur once in fifty years. It is impossible to guard against all possible eventualities. Risks must be taken. The degree of risk thought to be acceptable is based on the seriousness of the consequences of failure of the structure in question. Where the consequences are minor a high degree of risk is acceptable. Where the consequences are catastrophic only a slight risk is acceptable. Levees in parts of Holland, for example, are designed to withstand the one thousand year storm because failure would flood one-third of that nation.

This type of risk analysis has not generally been applied to the planning of water supply projects. Traditional water supply planning is based on the principle that unrestricted water should be available to all consumers during the dryest period of record. In the Bay Area this is the dry period experienced between 1928 and 1935. The present drought is more

severe than all earlier ones for which records are available. Consequently, if traditional water supply planning methods are retained and when the full extent of the current drought is known, future water supply projects will be sized to provide unrestricted water use during a drought as severe as the present one.

As noted previously the cost of new water supply projects in both monetary and environmental terms is high. On the other hand the cost and inconvenience of occasional restrictions on water supply may be slight. It appears worthwhile to examine the traditional approach to water supply planning in the light of these trade-offs. Perhaps it is better to live with a greater risk of rationed water supplies if it allows us to build less water supply projects.

INSTITUTIONAL ARRANGEMENTS FOR WATER SUPPLY

Water is supplied to Bay Area residents by 83 separate water distribution agencies from eight different sources. These institutional arrangements, developed in the first half of this century, were well suited to the needs of the time; growth was rapid, communities were separated by broad areas of undeveloped land, water was abundant and public perceptions of the environmental damage caused by massive engineering works was low.

Circumstances have changed. Growth is slowing down. Although most cities maintain separate governments, physically and economically they merge into one another and into a metropolitan whole. Water can only be regarded as abundant if we are prepared to support the cost and accept the environmental consequences of large-scale water storage and conveyance facilities. It is becoming clear that water supply planning must be undertaken from a regional perspective if we are to use the water available to the area in a way that delivers water to the consumer at a minimum monetary and environmental cost.

Division of responsibility for water supply among many agencies can lead to inefficiency. Each major agency operates fairly independently, securing its own sources. It is probable that this leads to the development of more separate sources than would be the case if water were distributed more efficiently within the region.

There are two ways to improve the efficiency of the Bay Area's water supply arrangements. A metropolitan water agency could be created that would be responsible for all aspects of water supply from planning to service delivery. The metropolitan agency would develop the best of the new water sources available to the region and distribute water to all parts of the region. Although an agency of this type would probably be an efficient arrangement its creation would obviously involve drastic institutional changes which would be extremely controversial and difficult to accomplish in a short time.

A second approach appears more promising. Most of the advantages of the metropolitan agency can be obtained if cooperation between existing agencies can be improved. Development of a mechanism for cooperative inter-agency water supply planning could lead to more efficient water use without the necessity for major institutional change.

WATER QUALITY PROBLEMS

Most Bay Area residents are supplied with water of unusually high quality. No serious water quality problems exist at the present. There is the possibility, however, that several problems might occur in the future if preventative measures are not taken.

Every year numerous new synthetic organic compounds are developed for various uses throughout human society. Inevitably some of these compounds find their way into the water supply albeit in minute concentrations. Evidence is accumulating that these substances may be harmful to health. It was in response to this and other concerns that Congress enacted the Safe Drinking Water Act of 1974. The full impact of the legislation is yet to be felt and consequently any analysis of its effectiveness in dealing with the problem is deferred until the "continuing planning" phase of the EMP.

A second cause for concern is contamination of groundwater. Groundwaters are a source of water supply to over 40 cities or water districts in the Bay Area. As the Bay Area population grows, and access to new fresh surface water supplies becomes more restricted, increasing demands will be placed upon local groundwaters.

Groundwaters can become contaminated due to overpumping. Removal of groundwater at a rate faster than it can be naturally replenished can lower the water table and let salty coastal water "pour" in. The settling or sinking of land above the depleted groundwater basin is another problem that has been observed in the Bay Area. Another source of contamination is surface water percolation into the groundwaters. Obvious problems lie with faulty septic tank drainfields or well casings that may permit direct bacterial contamination of groundwater. A less obvious but still significant problem can occur with properly operating septic tank systems or groundwater recharge programs using reclaimed wastewater. The dissolved mineral content of waters from these sources, particularly the nitrate ion, can cause serious health problems for persons drinking the contaminated groundwaters.

A number of the large water supply agencies are actively pursuing programs to protect or restore their groundwater basins. Also, the California Department of Public Health has labored to develop safe standards for groundwater recharge. Yet there are many locations within the Bay Area where no concerted effort is being undertaken to protect groundwaters from salt intrusion or poor quality recharge, particularly excess septic tank drainage.

In order to protect this vital Bay Area resource, a regionwide management plan must be developed. A current, serious obstacle to such an action is the lack of a complete regionwide assessment of all groundwaters, their extent, natural recharge rates, current and projected pumping rates, and recharge programs. It is essential that a comprehensive effort be undertaken to collect firm data establishing the total picture for all groundwaters within the region.

Chapter—5

Matching supply with demand

There are three ways to match water supplies with demand; we can use less water--water conservation*, we can use water twice--wastewater reclamation and reuse, or we can develop new sources. The effectiveness of each of these possible solutions to the water supply problem is described below.

WATER CONSERVATION

Conservation reduces the total demand for water. Because water is usually cheap and abundant it is often used wastefully; toilets are flushed to dispose of facial tissues or cigarette butts, lawns and crops are irrigated for unnecessarily long periods and industry and commerce has little incentive to recycle water. Total water use can be reduced by eliminating the waste without causing the consumer significant inconvenience.

Residential Water Conservation

Figure 2 shows the percentages of water used for different purposes in a typical household now and in the year 2000. Bay Area water managers concur that, at least in a suburban environment, between 5 and 15 percent of residential water demand is simply wasteful use associated with flushing toilets unnecessarily, running water incessantly while washing, brushing teeth, shaving or washing cars and over-irrigating yards. There are many approaches to water conservation. Some are discussed briefly below.

Consumer education--There is no doubt that, in a crisis, a well presented public information program will yield dramatic results. Faced with the most severe water shortage in the Bay Area, the Marin Municipal Water District began an information and rationing program in January, 1977. By July the program had achieved an extraordinary savings of 63 percent as compared to a normal year. The effectiveness of public information and consumer education programs in a non-crisis situation are much less predictable. Because many water-wasting practices are due to established behavior patterns the greatest long-term results can be achieved by educating the young.

Retrofit programs--A large number of devices that can be applied to existing plumbing fixtures are available for reducing water use in the home. Typical devices are toilet tank displacement bottles that reduce the flush

*During the drought, in most of the region "conservation" has come to mean reducing the amount of water used. In the water supply profession, "conservation" has historically meant storing (conserving) water in reservoirs for later use. In this report, "conservation" will have the former meaning, that of saving water by not using it.

the flush volume and shower head inserts that reduce maximum shower flow rates. Two model retrofit plans were considered in the development of this water supply plan. Both plans involve displacement bottles and shower head inserts but differ in the degree of effort employed to persuade the homeowner to install them. Under the "moderate" savings plan kits containing the water saving devices would be made available at distribution centers for pick up by consumers. Under the "maximum" savings plan kits would be delivered door-to-door. The "moderate" and "maximum" plans are estimated to result in savings of 1.7 and 4.1 gallons per person per day respectively.

Programs for new construction--Conservation devices built into new construction are more effective than the common retrofit devices. Devices include low-flush volume toilets, shower and faucet flow controllers that limit maximum flow rates, hot water pipe insulation to reduce "waiting time" for hot water, pressure regulators at individual homes, drought-tolerant landscaping, timer-controlled automatic sprinkler systems and trickle-drip irrigation systems. Two model savings plan were considered. A "moderate" savings plan employing most of the devices referred to above inside the home would result in savings of 16.6 gallons per person per day. The "maximum" savings plan, employing trickle-drip irrigation and automatic sprinklers outside the home, in addition to the same interior devices as in the "moderate" plan would result in savings of 31.6 gallons per person per day.

Conservation by Industry, Commerce and Public Authority

These types of consumers use water in a wide variety of ways. Because of this variation, and the scale of certain users the water utility should work with large users on a case-by-case basis to save water. Considerable amounts of water are used in commercial establishments and public agencies for sanitation purposes and landscape irrigation. The same water saving techniques applicable for residential customers are equally applicable to these institutions. More unusual conservation practices include use of soil-moisture detectors to more efficiently control landscape irrigation, use of recycled water in commercial refrigeration systems and elimination of "running water" situations such as dental office basins.

Industry uses water for cooling purposes, process water and for sanitation and irrigation. Cooling water use can be reduced by conversion from "once-through" to recycling systems.

Overall it appears that a 5 to 10 percent cut in water use by industry, commerce and public authority is reasonable.

Agricultural Water Conservation

Water conservation at the farm level can be achieved by leveling of land, shortening of irrigation runs, conversion to more efficient irrigation methods and by using low application rate techniques. Additional water can be saved at the irrigation district level by replacing open distribution canals with pipelines. Estimates of the water that might be saved

in this way on county-by-county basis were made. It was assumed that 50 to 60 percent of the irrigated area which will remain in agriculture until the year 2000 will install more efficient irrigation systems. In addition it was assumed that in the year 2000 a further five percent saving will occur as a result of improved matching of water applications with crop needs. Estimates of water use in the year 2000 with and without conservation together with the 1975 use rate are shown in Table 3. Even without conservation agricultural water use will decline as land is converted from agriculture to other uses.

Table 3.
Agricultural irrigation water use by county
(acre-ft/yr)*

County	1975	2000 Without Conservation	2000 With Conservation
Alameda	20,000	8,900	7,000
Contra Costa	121,900	95,600	85,400
Marin	2,400	900	600
Napa	21,500	19,800	18,800
San Francisco	0	0	0
San Mateo	8,200	9,700	9,200
Santa Clara	110,900	68,300	55,300
Solano	371,200	369,200	290,700
Sonoma	65,800	45,300	39,400
Region	722,500	617,700	506,400

Water Pricing

Consumers are charged for water in a number of different ways. The most commonly applied charging method is the declining commodity rate. This type of rate stems from the cost-of-service philosophy; because the cost of service per gallon of water delivered declines with the volume of water delivered, large consumers are charged a lower rate per gallon than are small consumers. This approach ignores the fact that resources are limited and tends to encourage water use. Also ignored are variations in peak demand which have a dramatic impact on the size of the water mains needed.

*An acre-foot of water is the amount needed to cover one acre at a depth of one foot. 1118 acre-feet per year is equal to one million gallons per day (mgd). To convert the figures in this table to mgd, divide by 1118, or roughly by 1000. Keep in mind, though, that crop irrigation occurs primarily in the growing season. On a day in July, the use would be higher than implied by this table; in January it would be lower.

It is often argued that water pricing to increase conservation is not feasible because the demand for water is inelastic. Like gasoline, the price can double, but people just go on using it at the same rate. Recent studies suggest, however, that residential irrigation demand is in fact sensitive to price and does follow the laws of supply and demand.

An approach being studied by several California utilities and already implemented by a few eastern utilities is application of a seasonal or peak demand rate. A base rate applies for all water use in a given billing period. Use in excess of 130 percent of each customers wintertime use is priced at several times the base rate. A study conducted in Marin indicated that a rate structure of this sort would result in a 11 to 12 percent reduction in water use.

Another instance of a common pricing arrangement that encourages wasteful use of water is the inclusion of minimum purchase requirements in wholesale water contracts. The retailer agrees in advance to take a certain minimum amount of water from the wholesaler regardless of need. In this way the wholesaler, being assured of a certain minimum revenue, can efficiently plan his operations in advance. Alternative pricing arrangements can satisfy the wholesalers need for an assured income and encourage water conservation.

The Effectiveness of Water Conservation in Reducing Demand

In order to determine the effectiveness of the various conservation measures described previously in reducing overall water demand it was necessary to assemble the measures in a number of alternative programs. Eight programs were considered; the two most promising programs are discussed here and shown on Table 4.

Conservation Alternative A consists of the "moderate" residential savings plan together with a five percent cut in residential use as a result of public education, a five percent cut in commercial, industrial and public authority use and implementation of the level of agricultural conservation described earlier. Conservation Alternative B is similar except that the "moderate" residential savings plan is replaced with the "maximum" plan. Table 4 shows water use by subregion in the year 2000 with and without conservation. By the year 2000 conservation Alternative A and B would save 223 and 260 mgd regionwide respectively.

WASTEWATER RECLAMATION AND REUSE

Reclamation and reuse of wastewater is not a new concept. Although it has never played more than a minor role in the Bay Area's water supply plans, its use dates back many years. Since 1932 Golden Gate Park has used treated wastewater for landscape irrigation and recreational lakes.

In 1976 there were over 200 wastewater reuse projects in operation in California; only ten of these were in the Bay Area. One reason that reuse has not been extensively practiced in this area is that the larger sewage treatment plants are located in areas somewhat remote from potential markets

for reclaimed water. Another reason is that the sewage was inadequately treated for reuse purposes. In the last five years however, higher treatment levels have been added at many plants; production of a higher quality effluent has made reuse a more attractive option and the number of reuse projects in the Bay Area is growing steadily.

Table 4.
Water use by sub-region in the year 2000
(million gallons per day)

Subregion	Without Conservation	Conservation Alternative A	Conservation Alternative B
East Bay	587	533	520
Peninsula	227	211	206
South Bay	474	426	414
Napa-Solano	486	402	397
Marin-Sonoma	182	163	157
Regional Total	1956	1733	1696
Water Saving	0	223	260

Limitations on Use of Reclaimed Wastewater

Because of its origins the possibility exists that reclaimed wastewater may contain bacteria or viruses harmful to man. Treatment processes, however elaborate, cannot be made completely foolproof. Although the risk of infection is probably slight the present water supply situation in California is not sufficiently desperate to justify taking even a slight risk. Consequently use of reclaimed wastewater is restricted to those uses that do not involve human ingestion.

Within the Bay Area the most promising reuse options are agricultural irrigation of certain types of crops, landscape irrigation and industrial use for cooling purposes. Permissible but less promising options include creation of artificial lakes, marsh enhancement and groundwater recharge when no chance of use of groundwater for drinking water supply exists.

Markets for Reclaimed Water

Few, if any water users would choose to use reclaimed wastewater if another source was available at the same cost. As a consequence markets for reclaimed water are not always easy to find.

No new work on the identification of future reuse markets was done during the preparation of this plan. Virtually every agency responsible for sewage service has conducted an analysis of reuse opportunities within its own service area as a prerequisite to receipt of a State or Federal grant for construction of sewage collection, treatment or disposal facilities. These study reports were reviewed and a large number of potential reuse

projects identified. Those projects which met certain financial, technical and environmental criteria were determined to be feasible and likely to be built. The capacity of the projects represents the probable market for reclaimed wastewater in the region.

Figure 3 shows how the market for reclaimed wastewater is expected to grow between now and the year 2000. Some of the major projects that are either under construction or planned in the region are described below.

On the Peninsula there are several golf courses and parks close to the sewage treatment plants which can be irrigated with reclaimed wastewater. Additionally there are crops in the Half Moon Bay Area that could be irrigated. In Santa Clara County a salt water intrusion barrier is being formed with tertiary treated effluent from the Palo Alto Treatment Plant. The project could be expanded in the future. The water will be pumped out and used for cooling water at Moffett Field. Reuse by agriculture is planned in the Gilroy and Milpitas areas.

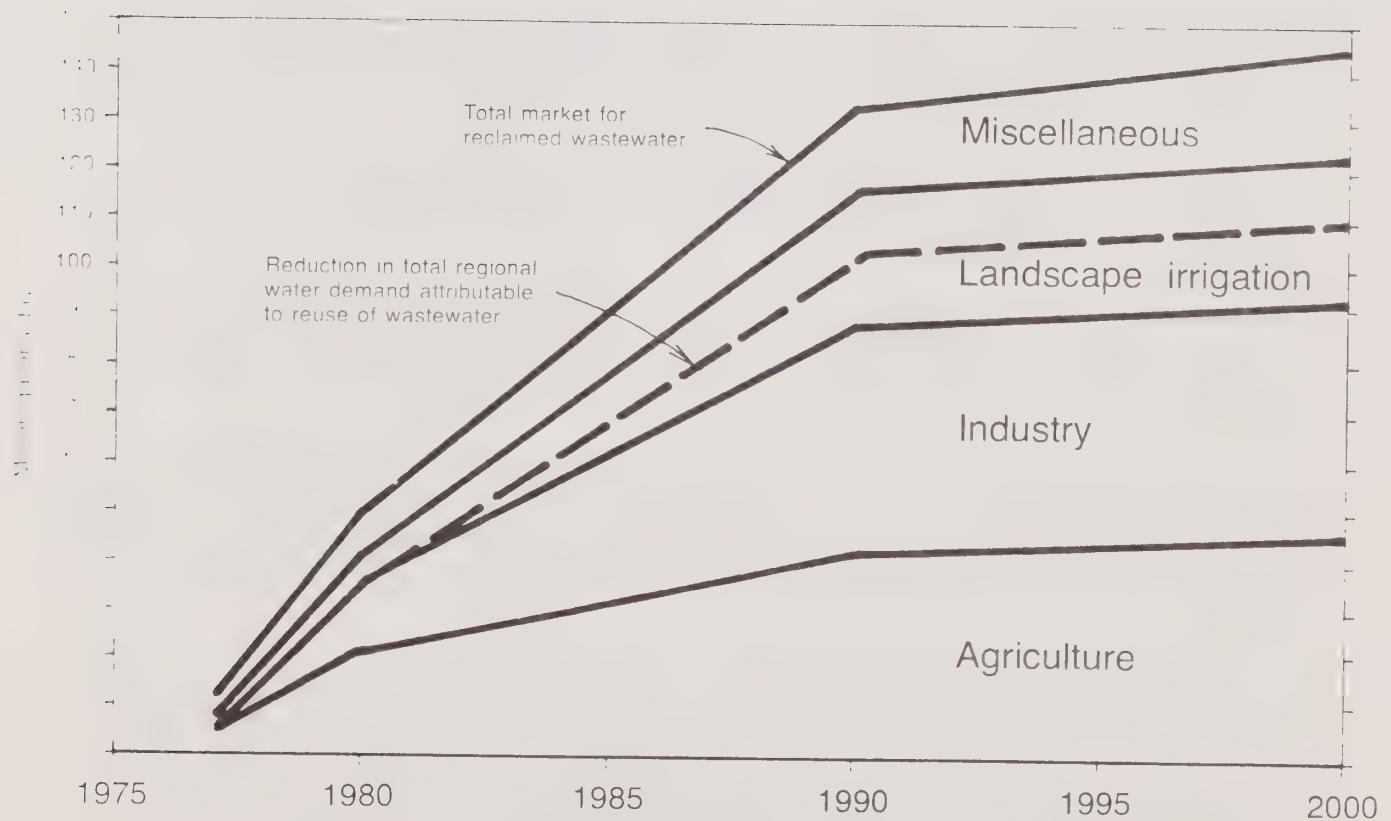
The largest reuse project in the Bay Area is the Central Contra Costa Sanitary District and Contra Costa County Water District's reuse project of 15 mgd for industrial cooling water in the Martinez area. Most of the project is already built. A market for an additional 15 mgd of industrial process water exists in the same area and the present project will probably be expanded. A similar project involving 11 mgd has been proposed by EBMUD in the Richmond area that would combine industrial reuse and reuse for landscape irrigation. Additional landscape irrigation demand exists near the San Leandro treatment plant and in the Union City area near the Union Sanitary District's plant.

In Marin County one landscape irrigation project is on-line at Los Gallinas and others are planned in Mill Valley and lower Ross Valley. Agricultural irrigation with reclaimed wastewater appears, from initial pilot scale testing, to be possible in the Novato area. A considerable amount of reuse for agricultural irrigation in Sonoma County is planned. The City of Santa Rosa, Petaluma and the Sonoma Valley area are all actively pursuing projects that will reuse initially all wastewater generated in the summer growing season for pasture and field crop irrigation. This project is known as the triple use project because it combines waste disposal, fodder irrigation and open space preservation.

Similar projects are already on-line in northern Napa County. The Napa County Sanitation District and the American Canyon County Water District have expressed an interest in using reclaimed wastewater in the Carneros area for crop irrigation and vineyard frost protection. A joint agricultural irrigation - marsh enhancement project is being implemented in the Fairfield area. The City of Vacaville is negotiating with the Solano Irrigation District over summer reuse for crop irrigation.

All in all there is currently much interest in wastewater reclamation. The drought has had the effect of speeding up some of these projects and creating some new ones on an emergency basis. It is important to stress that realization of this potential reuse market will require continued

Figure 3.
Markets for reclaimed wastewater



serious efforts to secure contracts or commitments from potential customers to promise to take the reclaimed wastewater on long-term basis and monies from grants and/or other sources to build the projects.

Reclaimed Wastewater As A Water Supply Source

The markets for reclaimed wastewater fall into two categories; situations where reclaimed wastewater is used to replace water that would otherwise have been obtained from another source and situations where the availability of reclaimed wastewater creates a market which would not otherwise have existed. Obviously satisfying the second type of market with reclaimed wastewater does not reduce total water demand. The dotted line on Figure 3 shows the reduction in water demand that would occur if all reuse projects, except those which create a new water use, were implemented. In 1980, approximately 36 mgd of fresh water could be reused, in 1990 approximately 101 mgd could be reused and by year 2000 about 110 mgd of reuse could be realized.

DEVELOPMENT OF NEW SOURCES

A number of large projects are under construction or are proposed which if completed will increase available water supply to approximately 2500 mgd during a dry year comparable with those experienced in 1928 through 1935. During a drought like the current one, the supply would be less, by 20-30%.

Expansion of the Hetch Hetchy aqueduct would allow San Francisco Water Department to import an extra 100 mgd for use in San Francisco, San Mateo, Santa Clara and Alameda Counties.

The East Bay Municipal Utilities District has contracted with the U.S. Bureau of Reclamation for approximately 134 mgd of American River water. A new aqueduct extending from the Folsom South Canal to Walnut Creek would have to be built to bring this water to the Bay Area.

The San Felipe Division of the Central Valley Project has been designed to supply water to Santa Clara, San Benito, Santa Cruz and Monterey counties. At capacity the project will bring 134 mgd to Santa Clara County. Construction has begun and will extend to 1983 when the first water deliveries are made.

The Warm Springs Dam on a tributary of the Russian River is being built by the U.S. Army Corps of Engineers. The dam will allow an extra 102 mgd to be withdrawn from the Russian River for use in Marin and Sonoma counties.

The State Department of Water Resources intends to build the North Bay Aqueduct in the early 1980's to deliver Sacramento River water to Solano and Napa counties. A maximum of 55 mgd has been contracted for.

The U.S. Bureau of Reclamation plans to study the feasibility of a West Sacramento Valley Canal Unit which if built could deliver 120 mgd to Solano County. It appears unlikely that this project will be built before the year 2000 and consequently it was not included in the subsequent analysis of supply and demand.

COST COMPARISON

Estimates of the cost of matching supply and demand in different ways were made and are shown in Table 5. The estimated costs should be regarded as approximate because they were derived from many sources which have used different assumptions and calculation procedures. They do, however, provide a rough basis for comparison.

The least expensive water is produced by "moderate" residential conservation. Agricultural conservation, subsidized wastewater reclamation and development of new sources are all within the same cost range. "Maximum" residential conservation and unsubsidized wastewater reclamation are more expensive in most cases.

Table 5.
Estimated cost of water obtained from various sources

Source	Cost ¢/1000 gallons
"Moderate" Residential Conservation	2-5
Agricultural Conservation	14-25
Subsidized Wastewater Reclamation ^a	5-30
New Sources	10-30
Warm Springs	10.4
Hetch-Hetchy	14.8
North Bay Aqueduct	21.8
San Felipe	24.0
American River	29.7
"Maximum" Residential Conservation	15-45
Unsubsidized Wastewater Reclamation	15-60

^a

Certain types of wastewater reclamation facilities are eligible for Federal and State grants.

Chapter—6

The regional supply and demand situation

It is always difficult to develop a convincing picture of how water demand and supply will match in the future. Many uncertainties enter into the projections. In this instance, the routine difficulties are compounded by the fact that we are presently experiencing a drought, the full extent of which remains unknown. For this reason this chapter describes two demand/supply scenarios or possible futures. The description is prefaced by a discussion of how the drought affects projections.

THE EFFECT OF THE CURRENT DROUGHT

The drought affects water supply and demand projections in two ways; first it changes our estimates of the amount of water existing and planned systems can reliably deliver; and secondly it alters patterns of water use in ways which will probably persist once the drought is over.

Safe yield and the drought

The capacity of a water supply system to deliver water is expressed in terms of the safe yield. The safe yield is the amount of water the system can deliver in the driest year of record. Safe yields for surface waters and groundwaters are different. The safe yield of surface water supplies is based on what could have been delivered during the 1928 to 1935 drought. The safe yield of groundwaters is the long-term average annual recharge; that is the amount of water averaged over a number of years that goes back into the groundwater body as a result of rainfall or man's activities such as crop irrigation or artificial recharge.

It is now apparent that the current drought is more severe than that experienced in 1928 to 1935. Once the drought is over and the reservoirs are full again and if traditional water supply planning practices are followed it will be necessary to revise downwards the safe yield estimates for both existing and planned surface water supplies.

Water use patterns

Public response to water agency requests to reduce water consumption during the drought has been dramatic. In many areas actual performance has substantially exceeded the goals of the individual savings programs. Examples are cuts in water use of 65 and 42 percent respectively in Southern Marin and the Contra Costa County Water District service area.

Much of the savings results from changes in human behavior. Most of these changes in habits - not running water while brushing teeth, not using the toilet to dispose of facial tissues, etc. - do not cause much, if any inconvenience. Some suburban homeowners may have discovered, after mourning the death of their lawns, that time previously spent on the care and maintenance of the yard can be spent more enjoyably in other ways. Overall it seems unlikely once the drought is over that individual water use will immediately, if ever, revert back to its pre-drought rate.

A part of the analysis supporting this plan involved projecting future water demand assuming no water conservation. Because of the drought, at least some conservation will continue. Thus reality is unlikely to bear out the "no conservation" demand curve.

THE REGIONAL SITUATION

The following analysis assumes that the facilities exist to distribute water to wherever it may be needed in the region, somewhat in the manner of the existing electrical power distribution system. This is not the case at present, a fact that will be discussed subsequently. Each of two regional demand/supply scenarios is described below together with the assumptions that they are based on.

New Drought Scenario

This scenario pictures the post-drought situation assuming no changes in present water supply planning practices. It is assumed that the winter of 1977-78 brings normal rainfall and ends the drought. In keeping with past practice the safe yields of existing and planned surface water supplies are revised downward to that amount of water they can reliably deliver in the driest years of record, now 1975 through 1977. This is estimated to be 74 percent of the pre-1975 surface water safe yields. The percentage reduction was estimated by one water agency in the region and is not concurred with by others. In the absence of any other data it was used here. When the drought is over this analysis will have to be repeated using more accurate information.

Figure 4 shows the New Drought Scenario. The dashed line shows the post-drought deliverable supply of existing and planned water supply facilities. The dotted line begins on the left of the figure at year 1975 with a value of about 1520 mgd, the existing deliverable supply. The line slopes upwards as time passes, reflecting the additional supplies available as new projects are completed, reaching a value of about 1870 mgd in the year 2000.

The solid line shows the estimated demand for water assuming no conservation or reuse. It is worth noting that the line begins in 1975 at a value of 1580 mgd, somewhat greater than the existing deliverable supply. This reflects the drought-caused gap between supply and demand currently being bridged by rationing programs.

Two dotted lines lie below the solid line. The upper dotted line shows estimated water demand assuming implementation of water conservation Alternative A, described previously. The lower dotted line shows estimated water demand assuming implementation of water conservation Alternative A and construction of all reasonably cost-effective wastewater reclamation projects.

Figure 4.

The new drought scenario

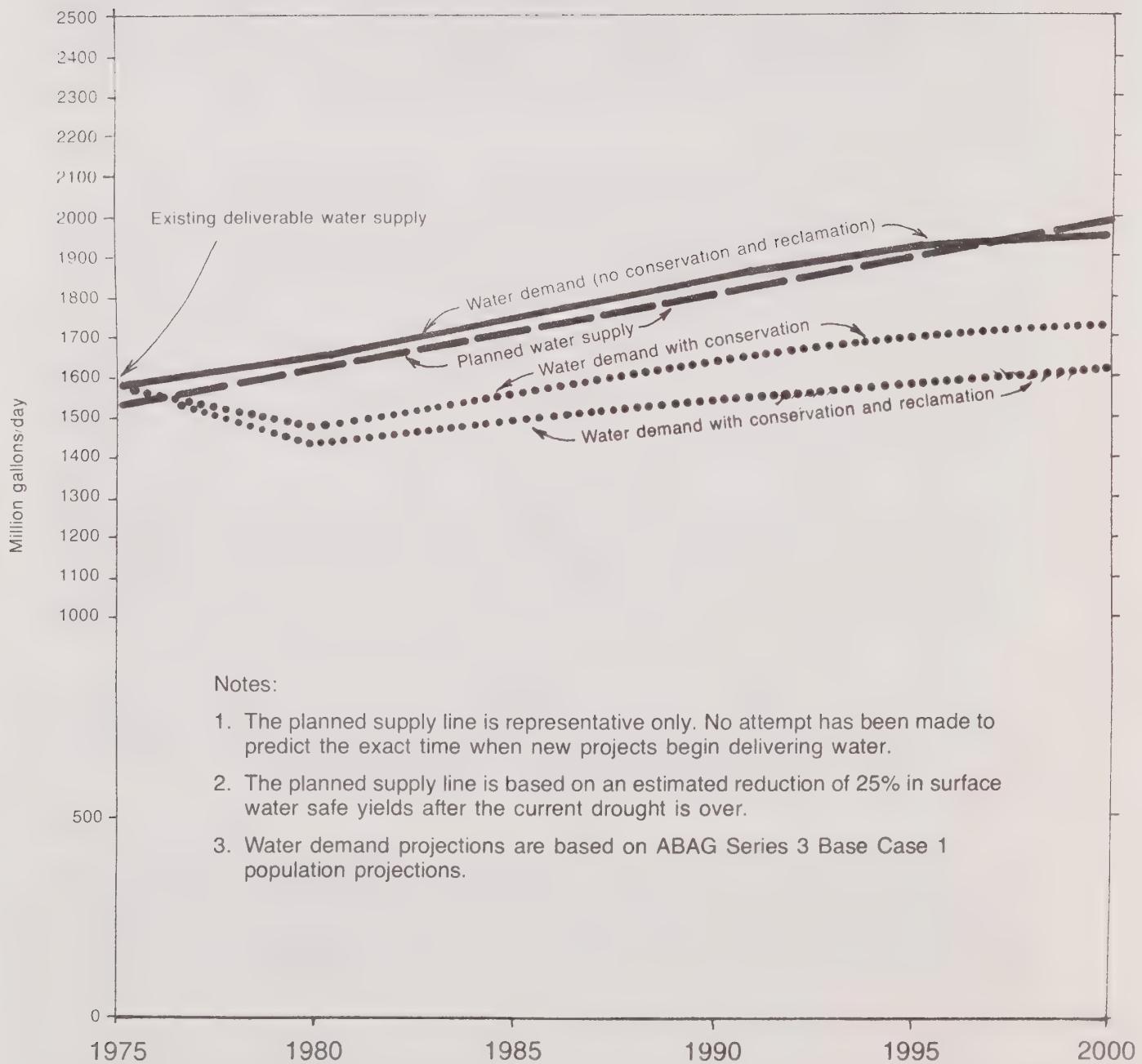
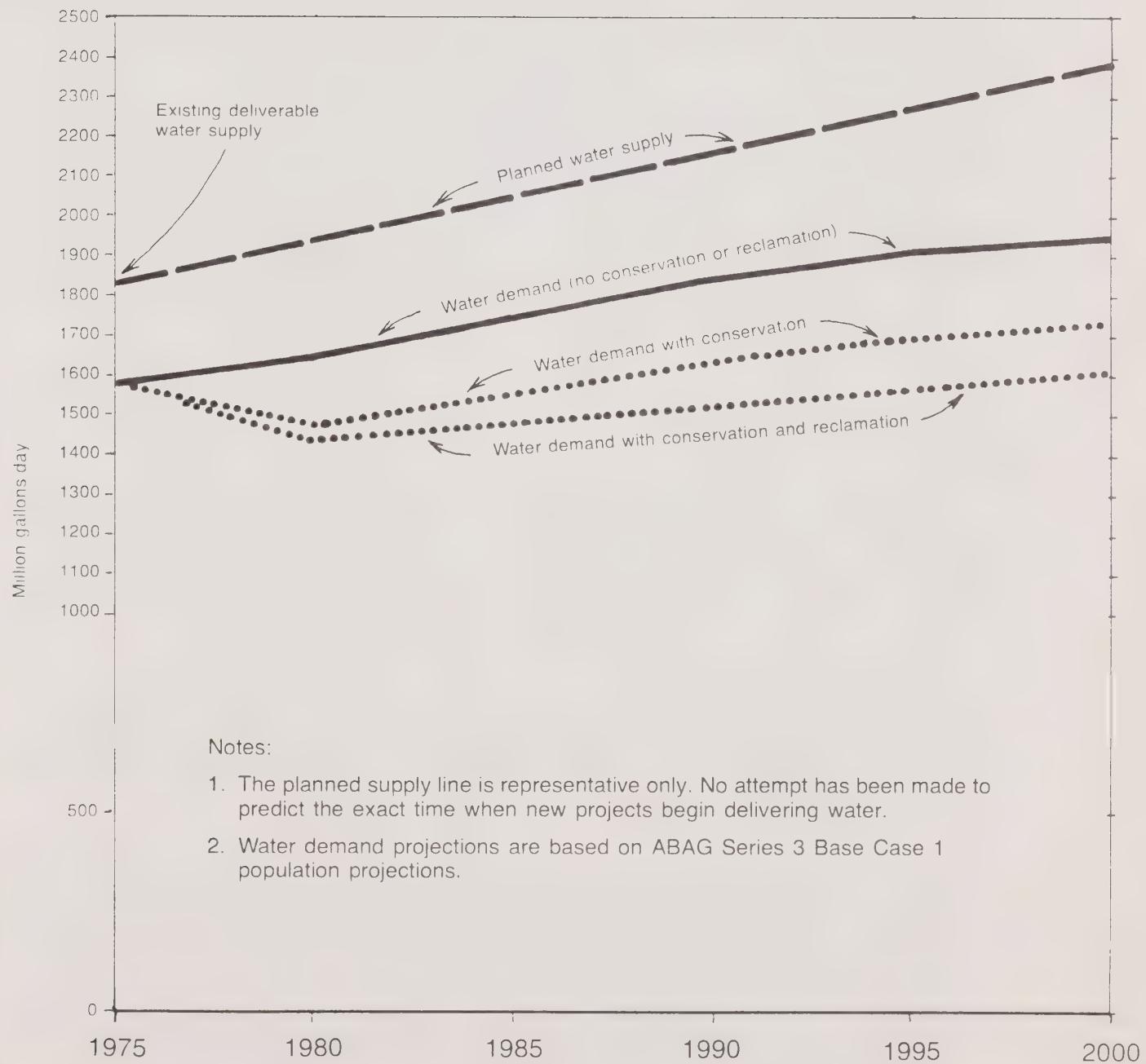


Figure 5.

The old drought scenario



If the New Drought Scenario presents a credible representation of reality then it follows that in 1977, if no conservation or reclamation were practiced, supply would fall short of demand by about 90 mgd or 6 percent. In the year 2000, if no conservation or reclamation were practiced, supply would still fall short of demand by about 4 percent, despite the construction of five major and several minor water supply projects. A reserve capacity of 8 percent will exist in that year if conservation is practiced. The reserve is increased to 15 percent by wastewater reclamation and reuse.

Old Drought Scenario

The basis for the Old Drought Scenario is that, once the current drought is over, a determination is made that the 1975-1977 drought was an extremely unusual phenomenon - one that is unlikely to recur again in the next one hundred years. It is decided that water supply systems should not be designed to deliver unrestricted water during such a severe drought. Better to put up with the possibility that water might have to be rationed in the unlikely event of a recurrence rather than spend money on rarely, if ever used, facilities. Accordingly, conventional water supply planning practices are modified. Water supply systems continue to be designed to provide unrestricted water during a less severe drought, the 1928-35 drought. For this reason the safe-yields or deliverable supply of existing and planned systems are also based on the 1928-35 drought. In most respects the Old Drought Scenario is similar to the supply/demand picture that would exist had the current drought never occurred.

The meaning of the lines on Figure 5, which represents the Old Drought Scenario, is the same as in Figure 4 (New Drought Scenario) - only the values have been changed.

Ignoring the 1975-77 drought, deliverable supply in 1977 would have exceeded demand, assuming no conservation or reuse, by 250 mgd or about 15 percent. By the year 2000, if all planned supply projects are built, reserve capacity will increase to 23 percent. Reserve capacity would increase still further to 39 percent and 49 percent if water conservation alone or conservation and reclamation were practiced.

Some interim conclusions

If the New Drought Scenario were to occur it is apparent that it will be necessary to build all presently planned new projects and implement some measure of conservation and reclamation if supply is to match demand in the year 2000.

Even if water conservation Alternative A and wastewater reclamation, to the extent described earlier are practiced fully, a reserve capacity of only about 15 percent is produced. Bearing in mind that at most times some reserve is desirable because major water supply projects take many years to build, full implementation of conservation and reclamation under the New Drought Scenario might justify slightly delaying construction of some new projects; the projects would clearly still be needed, however. Again it is worth noting that the discussion, so far, assumes that water can be distributed freely within the region.

Turning to the Old Drought Scenario's rosier picture of supply and demand; if all presently planned supply projects were built and water conservation and wastewater reclamation practiced extensively the region would have a reserve capacity of about 50 percent. Clearly more than enough. The possibility that some of the presently planned projects need not be built obviously exists. Such a conclusion must be tempered, however, by the fact that in the absence of ties between water systems there are sub-regional supply and demand imbalances. The importance of these are discussed in the following section.

THE SUB-REGIONAL SITUATION

The facilities to move water from any of the region's sources to any area within the region that needs water do not exist. Consequently there are subregional variations in the demand/supply situation within the region. The discussion of the subregional differences is followed by some speculations on how better intra-basin distribution of water might solve some subregional problems and lead to more efficient use of water sources available to the region. The concepts of the Old and New Drought Scenarios and the assumptions they depend on are retained in the discussion of the subregions. Table 6 shows the reserve capacity each subregion has now and in the future under each scenario.

New Drought Scenario

Considering first the New Drought Scenario, it is apparent that, although the region as a whole has a supply shortfall of only 6 percent, Marin/Sonoma and Napa/Solano have supply shortfalls of 17 percent while the East Bay has a 15 percent reserve. In the year 2000, assuming no conservation and reclamation, the region still has a shortfall of about 4 percent. Marin/Sonoma, Napa/Solano and South Bay subregions all exhibit deficits. If conservation and reclamation is implemented all subregions will have some reserve capacity varying from 4 percent in Napa/Solano to 33 percent in the East Bay. The region as a whole would have a 15 percent reserve.

If it were possible to distribute water easily within the region a very minor conservation effort applied regionwide would balance supply with demand in the year 2000. In the absence of the necessary system interties vigorous conservation and reclamation efforts will be necessary in the South Bay and Napa/Solano subregions. No similar effort will be needed in the other subregions.

Old Drought Scenario

To reiterate the Old Drought Scenario assumes that the current drought is a rare phenomenon - not likely to recur in the next one hundred years. The safe yields of our water supply systems remain based on the 1928-35 drought.

Table 6.
Water demand/supply situation by subregion

Subregion	1975 Demand mgd	Reserve Capacity - percent						Old Drought Scenario 2000 No conserv/ reclamation	2000 with conserv/ reclamation		
		New Drought Scenario X		2000 No conserv/ reclamation	2000 with conserv/ reclamation	1975					
		1975	2000								
Peninsula	202	-8	5	20	22		40		60		
South Bay	360	-10	-11	5	1		9		28		
East Bay	475	+15	9	33	46		42		77		
Marin/Sonoma	131	-17	8	22	-6		32		49		
Napa/Solano	412	-17	-21	4	1		-4		26		
Region	1580	-6	-4	15	15		23		49		

From Table 6 it is clear that the only subregion with a supply shortfall in 1975 is Marin/Sonoma. If all planned water projects are built the regional reserve capacity will rise to 23 percent without conservation and reclamation and to 49 percent with conservation and reclamation. Without conservation and reclamation reserve capacity will vary from 42 percent in the East Bay to a 4 percent deficit in Napa/Solano. In the absence of system interties and assuming all planned water supply projects are built conservation and reclamation would only be necessary in Napa/Solano.

System Interties

System interties appear to be desirable or at least worthy of serious consideration for two reasons. First, the regional differences in water supply assurance described above could be evened out. Secondly, and more importantly, interties could lead to more efficient use of our existing sources and a reduced need to develop new ones. This can be illustrated as follows with reference to the New Drought Scenario in the year 2000 assuming conservation and reclamation have been implemented. If it is assumed that a 15 to 20 percent reserve capacity is desirable, then both the South Bay and Napa-Solano subregions would have a less than desirable reserve. On the other hand the East Bay and, to a lesser degree, the Peninsula and Marin/ Sonoma would have ample reserves. If interties were built reserves could be shared, resulting in a satisfactory regional reserve capacity of about 15 percent. In the absence of interties both the South Bay and Napa-Solano subregions would likely develop independent new sources which, viewed from a regional perspective, are not necessary.

The plan

The recommended water conservation, reuse and supply plan consists of a list of principles or policies that will guide water supply planning in the future. Each policy is accompanied by a series of actions designed to implement the policy.

Table 7 lists the plan recommendations. The policies and their implementing actions are listed in the first column headed recommendations. For each action subsequent columns of the table show the agencies responsible for implementing the action, the implementation schedule, legal authority of the agency to implement the action, cost, source of funding, measures to ensure implementation and the environmental, institutional/financial, economic and social impacts of the action.

The purpose of the following narrative is to serve as an aid to understanding the contents of the table.

Policy Provide a safe and reliable water supply to all citizens at a minimum monetary and environmental cost.

This policy simply restates the principle that has guided most of the region's water supply agencies in the past. Compliance with the latter part of the policy "at a minimum monetary and environmental cost" makes interagency cooperation a necessity, a fact that is reflected in the following actions.

Actions

Probably the most important recommendation contained in this plan pertains to the formation of a water management coordinating committee (WMCC). This committee, which could be organized informally or perhaps formalized by a joint powers agreement, would provide the forum for discussion and possible resolution of issues of mutual interest to agencies concerned with water management. The committee will include representatives of both the water and wastewater agencies. Although some of the matters before the committee will concern only one or the other type of agency it appears preferable to form a single committee rather than two because this better reflects the interrelationships between water supply and wastewater disposal.

Several other actions under this policy recommend studies or planning activities of mutual interest to water agencies that should be undertaken by the WMCC. Recommended studies include an evaluation of the feasibility of increased interagency transfers under both routine and emergency conditions. A reexamination of the desirability of supplying unrestricted water to all consumers, even under the worst conditions which may occur very infrequently, is recommended. The preparation of interagency-coordinated drought contingency plans is recommended.

Several actions are recommended to prevent future groundwater pollution problems such as saltwater intrusion and high-nitrate levels resulting from septic tank discharges.

Policy Encourage water savings

It is apparent that the least expensive way to progress toward matching water supply and demand is to reduce residential demand to a moderate degree. Clearly it is in the region's interest to do this. More intensive residential water saving and agricultural water conservation are no more costly than development of new sources of water and have few, if any adverse, environmental effects. Both of these options are promising but need further evaluation.

Actions

It is recommended that water agencies establish or continue water savings programs that include residential measures similar to those described earlier as the "moderate" water savings plan. The "moderate" plan encourages retrofit of water saving devices in existing housing and mandates building-in water saving devices in all new construction. Building codes should be updated to include water saving devices over and above those already required by State law. The building industry is already voluntarily installing water saving devices in some areas.

Studies should be conducted under the direction of the WMCC to determine the public acceptability of more stringent residential water saving and the feasibility of agricultural water conservation. More stringent residential water savings might involve restrictions on certain types of landscaping and landscape irrigation methods. Agricultural water saving may be infeasible unless it is part of a statewide program.

Actions are recommended to encourage water saving by providing tax incentives for retrofitting of water saving devices such as low-flush toilets in existing homes and by revising water rate structures that result in lower unit costs to large water users.

Effective water conservation depends on a high level of public awareness of the consequences of wasteful water use. It is recommended that this be maintained at least in part by a regionally coordinated public information program and by annual reporting of progress in the water savings field.

Policy Encourage reuse of wastewater where cost-effective

The unsubsidized cost of reclaimed water is usually higher than the cost of water from new sources. Monetary costs, however, do not take account of the fact that using water twice has a much smaller adverse environmental impact than developing new sources. Federal and State grants are available to pay part of the construction cost of wastewater reclamation and reuse facilities. Because of this subsidy, the local cost of reclaimed water is reduced, making it competitive with other water sources. It appears to be in the region's interest to construct all reclamation projects that will produce water that is price-competitive with other sources.

Actions

It is recommended that a regional wastewater reclamation study be conducted. The study is intended to determine whether large-scale reclamation of Bay Area wastewaters for use by agriculture in the Central Valley is feasible

and if any subregional reclamation opportunities exist other than those already being pursued by local agencies. A study of this type has been planned for some time and appears likely to commence shortly under the direction of a joint powers agency made up of major water and sewerage agencies and funded in part by the State and Federal through the Clean Water Grants Program. The joint powers agency could form the nucleus of the WMCC.

As noted earlier, State and Federal funds are available to supplement local funds in paying for the cost of construction of wastewater reclamation facilities. It is recommended that priority for grant funding can be given to reclamation projects that produce water that replaces an existing use.

Table 7.

Plan recommendations

Water supply management plan recommendations

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL * COST/YR. OF RECOMMENDED ACTION	PORTION OF * TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
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Policy—1

PROVIDE A SAFE AND RELIABLE WATER SUPPLY TO ALL CITIZENS AT A MINIMUM MONETARY AND ENVIRONMENTAL COST.

* This column presents annualized costs. The annualized cost is the amount of money per year that would amortize the total cost of the program over the period 1978-2000 at a 6-3/8% interest rate.

Action 1.1

Establish water resource management coordinating committee (WMCC).

The WMCC will include representatives of all major water and wastewater agencies in the Bay Area. The WMCC will provide a forum for discussion and resolution of issues of mutual interest to water management agencies.

WMCC

March 1978
Joint Exercise of
Powers Act

\$9,400

\$9,400

Dues paid by committee members

Voluntary

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
<u>Air Quality</u> o May indirectly deteriorate local air quality through increased growth by providing water to water limited areas.	<u>Financial</u> o See actions. <u>Institutional</u> o See actions.	<u>Production of Goods and Services</u> o Assures continued production by businesses dependent upon adequate fresh water supplies. o Assures continued agricultural production on irrigated land.	<u>Housing Supply</u> o May permit increased housing starts in areas that were limited by water shortages.
<u>Water Quality and Quantity</u> o Should assure adequate supplies of high quality water. o Specific projects may adversely and/or beneficially affect water quality and quantity of sources.		<u>Income and Investment</u> o May require investment funds for capital facilities. o Promotes healthy economic climate which attracts investment funds. o Aids in maintaining income by assuring production will not be restricted due to lack of water supplies.	<u>Physical Mobility</u> o No impacts. <u>Health and Safety</u> o Promotes health of population through provision of safe and low-salt water supplies.
<u>Physical Resources</u> o Provision of water supplies affects development of land related resources including agriculture, housing, industry. o Provision of water supplies can increase agricultural productivity over that of dry-land farming.		<u>Consumer Expenditures</u> o Adequacy of water supplies keeps water costs to consumers lower than does shortage of supplies. o Adequacy of water supplies keeps production costs down and therefore consumer prices.	<u>Sense of Community</u> o No impacts. <u>Equity</u> o No impacts. <u>Urban Patterns</u> o Adequate water supplies favor irrigated agricultural and low density urban land uses (both have approximately same demands) over dry-land farming and grazing. o High density multiple dwelling land use appears to require more water.
<u>Energy</u> o Water projects require energy for construction and operation of facilities and water distribution. o May indirectly increase energy demands locally by permitting urban growth. o Fresh water supplies are needed for power generating stations.		<div style="border: 1px solid black; padding: 5px;">Note: Impacts presented with policy are common to all actions under that policy.</div>	
<u>Amenities</u> o Adequate water supplies are considered essential amenities by many for enjoyment of life.			
Impacts same as noted for Policy 1.	<u>Financial</u> <u>Direct Public Cost of Implementation</u> o (1978) \$2,000 (cost to ABAG for sponsoring first meeting) o (1979-2000) \$10,000/year (Total cost to local water supply agencies to maintain committee)	Impacts same as noted for Policy 1.	Impacts same as noted for Policy 1.
	<u>Institutional</u> o Requires cooperation of numerous water supply agencies. o Requires complex development of Joint Powers Agreement.		

WATER CONSERVATION, REUSE AND SUPPLY MANAGEMENT PLAN RECOMMENDATIONS (continued)

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 1.2 Evaluate the benefits and feasibility of increased inter-agency water transfers.		WMCC	July 1978		\$8,000	\$8,000	Dues paid by committee members	
Action 1.3 Evaluate the costs and benefits of accepting restrictions on water use during droughts.		WMCC	July 1978	Water agency enabling legislation	\$16,000	\$16,000	Dues paid by committee members	
Action 1.4 Construct needed water supply projects.		Water agencies		Water agency enabling legislation	\$15,000,000	-0-	User charges + State/Federal grants	
Action 1.5 Prepare a drought contingency plan.		WMCC/ Water Agencies	1978		\$32,000	\$32,000	User charges	

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
Impacts same as noted for Policy 1.	<u>Financial</u> Direct Public Cost of Implementation <ul style="list-style-type: none"> o (1978-1979) \$100,000 (estimated cost of study) o Financing would come from water agencies Other institutional impacts are the same as noted for Action 1.1.	Impacts same as noted for Policy 1.	Impacts same as noted for Policy 1.
Impacts same as noted for Policy 1.	<u>Financial</u> Direct Public Cost of Implementation <ul style="list-style-type: none"> o (1978) \$200,000 (estimated cost of study) <u>Institutional</u> <ul style="list-style-type: none"> o Study results may affect agency planning criteria for water supplies. 	Impacts same as noted for Policy 1.	Impacts same as noted for Policy 1.
<u>Physical Resources</u> <ul style="list-style-type: none"> o Construction of water supply projects may provide water-related recreation areas. o Construction of some water storage projects may inundate land with other uses or may destroy natural character of some river portions. <u>Amenities</u> <ul style="list-style-type: none"> o Storage facilities and above ground pipelines would visually alter landscape. o Noise would be heard locally at construction sites. Other environmental impacts are the same as noted for Policy 1.	<u>Financial</u> Direct Public Cost of Implementation <ul style="list-style-type: none"> o (1978-2000) \$581,000,000 (estimated construction costs during period) o \$16,100,000/year (estimated operation and maintenance costs of combined projects) o Agencies would obtain funds from reserves or sale of bonds. Funds would be replaced by user charges. <u>Institutional</u> <ul style="list-style-type: none"> o Construction of water supply/storage projects is associated with serviced population growth and growth of water supply agency. 	Impacts same as noted for Policy 1.	<u>Physical Mobility</u> <ul style="list-style-type: none"> o Temporary, local disruption of travel may result from project construction. Other social impacts are the same as noted for Policy 1.
Impacts same as noted for Policy 1.	<u>Financial</u> Direct Public Cost of Implementation <ul style="list-style-type: none"> o (1978) \$400,000 (estimated) Other institutional impacts are the same as noted for Action 1.1.	<u>Production of Goods and Services</u> <ul style="list-style-type: none"> o Assures equitable distribution of water supplies among consumers, agriculture and industry. Other economic impacts are the same as noted for Policy 1.	Impacts same as noted for Policy 1.

WATER CONSERVATION, REUSE AND SUPPLY MANAGEMENT PLAN RECOMMENDATIONS (continued)

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YR. OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 1.6 Conduct survey of status, use, and plans for all groundwaters in region.		WMCC	1978-79		\$16,000	\$16,000	Dues paid by committee members, Federal grants	Voluntary
Action 1.7 Prepare regional groundwater basin management plan.	Contingent upon results of 1.6.	WMCC, ABAG, RWQCB	1979-80 PL92-500 Sec. 208	Undetermined	A11	Local funds supplemented by State and Federal grants		Voluntary

Policy—2

ENCOURAGE WATER SAVING.

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
Impacts same as noted for Policy 1.	<u>Financial</u> Direct Public Cost of Implementation <ul style="list-style-type: none"> o (1978-79) \$200,000 (estimated) <u>Institutional</u> <ul style="list-style-type: none"> o Would provide all agencies with total regional picture of groundwater use. 	Impacts same as noted for Policy 1.	Impacts same as noted for Policy 1.
Impacts same as noted for Policy 1.	Impacts same as noted for Policy 1.	Impacts same as noted for Policy 1.	Impacts same as noted for Policy 1.
		Other impacts of this the action would be determined by an assessment of the features of the regional groundwater basin management plan.	
<u>Air Quality</u> <ul style="list-style-type: none"> o No impacts. <u>Water Quality and Quantity</u> <ul style="list-style-type: none"> o Estimated 6.5% reduction in water use of existing developments. o Estimated 21% reduction in water needs of new developments. o With conservation, existing and proposed water supplies can serve greater population. <u>Physical Resources</u> <ul style="list-style-type: none"> o No impacts. <u>Energy</u> <ul style="list-style-type: none"> o Reduced demand for energy needed to supply water. <u>Amenities</u> <ul style="list-style-type: none"> o Some discouragement to luxurious and wasteful water uses. 	<u>Financial</u> <ul style="list-style-type: none"> o See actions. <u>Institutional</u> <ul style="list-style-type: none"> o Direct changes in legal capabilities of agencies. o New legislation and building code revision required. 	<u>Production of Goods and Services</u> <ul style="list-style-type: none"> o Increase in production of water conserving devices. o Increased need for plumbing services to repair old systems. <u>Income and Investment</u> <ul style="list-style-type: none"> o No impacts. <u>Consumer Expenditures</u> <ul style="list-style-type: none"> o See actions. 	<u>Housing Supply</u> <ul style="list-style-type: none"> o Existing housing costs should not be affected--retrofitted conservation devices average \$1/home. o Increased maintenance of older and substandard homes. o Minor cost increase to new homes. <u>Physical Mobility</u> <ul style="list-style-type: none"> o No impacts. <u>Health and Safety</u> <ul style="list-style-type: none"> o No impacts. <u>Sense of Community</u> <ul style="list-style-type: none"> o No impacts. <u>Equity</u> <ul style="list-style-type: none"> o Increased new house costs represent a larger portion of total cost of lower priced housing. o Agricultural conservation costs may put Bay Area farmers at comparative but temporary disadvantage. o Farmers implementing conservation measures will suffer less from future ultimate water shortages. <u>Urban Patterns</u> <ul style="list-style-type: none"> o No impacts.

WATER CONSERVATION, REUSE AND SUPPLY MANAGEMENT PLAN RECOMMENDATIONS (continued)

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 2.1 Implement residential water savings programs.	"Moderate" residential water savings programs are recommended. These emphasize encouraging retrofit of water savings devices in existing homes and mandating building-in of water savings devices in new construction.	Water supply agencies/ Homeowners	Dec. 1978	Water agency enabling legislation	Undetermined	All	User charges and private funds	Voluntary
Action 2.2 Revise and update building codes to include water conservation devices in new construction.		Cities & Counties	Dec. 1978 Continuous	City charters	\$1,420,000	\$1,270,000	City and county funds	Additional State legislation may be necessary
Action 2.3 Establish regionally coordinated public information/education program.		WMCC/ ABAG	Dec. 1978		\$8,600	\$8,600	Dues paid by committee members	
Action 2.4 Enact legislation to provide incentives for retrofitting domestic water conservation devices and agricultural water conservation.		State Legislature/US Congress	Dec. 1978		Undetermined	Undetermined		

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
Impacts same as noted for Policy 2.	<p><u>Financial</u></p> <ul style="list-style-type: none"> o Uncalculated cost for public agencies to reduce their water use. <p><u>Institutional</u></p> <ul style="list-style-type: none"> o Water supply agencies would need to promote conservation programs. 	<p><u>Consumer Expenditures</u></p> <p>Direct Private Cost of Implementation</p> <ul style="list-style-type: none"> o (1980) \$1.00/household o (1980) \$1,770,000 (estimated total cost of flow restrictors on existing housing). <p>Other economic impacts are the same as noted for Policy 2</p>	Impacts same as noted for Policy 2.
Impacts same as noted for Policy 2.	<p><u>Financial</u></p> <p>Direct Public Cost of Implementation</p> <ul style="list-style-type: none"> o (1978) \$45,000 (estimated cost to change building codes). o These activities fall within normal duties of city and county government. <p><u>Institutional</u></p> <ul style="list-style-type: none"> o City and county governments must investigate devices and pass appropriate ordinances. 	<p><u>Production of Goods and Services</u></p> <p>Employment - a small employment increase of less than 80 for the manufacture and installation of water conserving devices.</p> <p><u>Income and Investment</u></p> <ul style="list-style-type: none"> o No impacts. <p><u>Consumer Expenditures</u></p> <p>Direct Private Cost of Implementation</p> <ul style="list-style-type: none"> o \$30 per new dwelling unit for installation of moderate plan conservation devices. o (1975-2000) \$26,680,000 (estimated total cost to new housing). 	Impacts same as noted for Policy 2.
Impacts same as noted for Policy 2.	<p><u>Financial</u></p> <p>Direct Public Cost of Implementation</p> <ul style="list-style-type: none"> o (1979) \$50,000 o (1980-2000) \$5,000/year (billboards, radio, T.V., newspapers and brochures). <p><u>Institutional</u></p> <ul style="list-style-type: none"> o No Impacts. 	<p><u>Consumer Expenditures</u></p> <ul style="list-style-type: none"> o No impacts--too small to measure. <p>Other economic impacts are the same as noted for Policy 2.</p>	Impacts same as noted for Policy 2.
Impacts same as noted for Policy 2.	<p><u>Financial</u></p> <p>Direct Public Cost of Implementation</p> <ul style="list-style-type: none"> o Uncalculated cost of enacting legislation. o If legislation features tax incentives--the cost to government is uncalculated. <p>Other institutional impacts are the same as noted for Policy 2.</p>	<p><u>Consumer Expenditures</u></p> <ul style="list-style-type: none"> o Potential tax incentives can mean temporary savings to consumers. o Government revenues lost to tax incentives may ultimately be recouped in other taxes. <p>Other economic impacts are the same as noted for Policy 2.</p>	Impacts same as noted for Policy 2.

WATER CONSERVATION, REUSE AND SUPPLY MANAGEMENT PLAN RECOMMENDATIONS (continued)

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YR. OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 2.5 Publish annual water use and conservation report.		WMCC/ABAG	Ongoing		\$18,000	\$18,000	Dues paid by committee members	
Action 2.6 Revise water-rate structures to encourage conservation.		Water supply agencies	Dec. 1978	Water agency enabling legislation	Undetermined	A11	User charges	
Action 2.7 Conduct study to determine savings in sewage treatment costs attributable to water conservation.		WMCC/ABAG	April 1978		\$4,000	\$4,000	State & Federal grant may be available	
Action 2.8 Implement agricultural water conservation program.	This recommendation would require farmers to adopt more efficient irrigation measures. It would require State legislation and would only be feasible on a Statewide basis.	Farmers, irrigation districts			\$3,780,000	\$3,780,000	Private funds	

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
Impacts same as noted for Policy 2.	<p><u>Financial</u></p> <p>Direct Public Cost of Implementation</p> <ul style="list-style-type: none"> o (1979-2000) \$20,000/year (report preparation, printing and distribution). o Ultimate funding source is water charges paid to water agencies. <p><u>Institutional</u></p> <ul style="list-style-type: none"> o No impacts. 	<p><u>Consumer Expenditures</u></p> <ul style="list-style-type: none"> o No impacts--too small to measure. <p>Other economic impacts are the same as noted for Policy 2.</p>	Impacts same as noted for Policy 2.
Impacts same as noted for Policy 2.	<p><u>Financial</u></p> <ul style="list-style-type: none"> o Increased revenues to water agencies from large volume water users. o If cost of delivering water remains constant, one could expect decreased revenues from small users. <p><u>Institutional</u></p> <ul style="list-style-type: none"> o Decisions by agencies on water rates will be subject to sharper scrutiny. 	<p><u>Production of Goods and Services</u></p> <ul style="list-style-type: none"> o The cost of goods produced with large volumes of water can be expected to increase. o Some marginally profitable industries that could not conserve water may be forced to close. <p><u>Income and Investment</u></p> <ul style="list-style-type: none"> o Expected investment in water conservation devices for large users. <p><u>Consumer Expenditures</u></p> <ul style="list-style-type: none"> o Prices of some goods will go up. o Price of water to small user might go down. 	Impacts same as noted for Policy 2.
<u>Water Quality and Quantity</u> <ul style="list-style-type: none"> o No impacts. <u>Energy</u> <ul style="list-style-type: none"> o No impacts. <u>Amenities</u> <ul style="list-style-type: none"> o No impacts <p>Other environmental impacts are the same as noted for Policy 2.</p>	<p><u>Financial</u></p> <p>Direct Public Cost of Implementation</p> <ul style="list-style-type: none"> o (1978) \$50,000 (estimated cost of study). o Could lead to revised estimates of costs of providing sewage treatment. <p><u>Institutional</u></p> <ul style="list-style-type: none"> o Could delay expansion of sewage facilities and reduce size of new facilities. 	<p><u>Production of Goods and Services</u></p> <ul style="list-style-type: none"> o Uncalculated reduction in projected need for sewage facilities construction. <p><u>Income and Investment</u></p> <ul style="list-style-type: none"> o Possible reduction in investment funds needed for facilities construction. <p><u>Consumer Expenditures</u></p> <ul style="list-style-type: none"> o Possible reductions in sewer service charges. 	<u>Housing Supply</u> <ul style="list-style-type: none"> o No impacts. <u>Equity</u> <ul style="list-style-type: none"> o No impacts. <p>Other social impacts are the same as noted for Policy 2.</p>
<u>Water Quality and Quantity</u> <ul style="list-style-type: none"> o Estimated 15% saving in projected year 2000 agricultural water needs. <p>Other environmental impacts are the same as noted for Policy 2.</p>	<p><u>Financial</u></p> <ul style="list-style-type: none"> o No impacts. <p><u>Institutional</u></p> <ul style="list-style-type: none"> o Reduced demands upon water supplied by irrigation districts. 	<p><u>Consumer Expenditures</u></p> <p>Direct Private Cost of Implementation</p> <ul style="list-style-type: none"> o (1980) \$62,800,000 (estimated capital expenditures by farmers). o Increased prices of farm products unless conservation devices offset potentially higher cost of water in future. <p>Other economic impacts are the same as noted for Policy 2.</p>	Impacts same as noted for Policy 2.

WATER CONSERVATION, REUSE AND SUPPLY MANAGEMENT PLAN RECOMMENDATIONS (continued)

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
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Policy—3

ENCOURAGE REUSE OF WASTEWATER WHERE COST-EFFECTIVE.

Action 3.1 Conduct regional reclamation study.	WMCC	Nov. 1977	Porter-Cologne Act & Federal Water Pollution Control Act	\$161,000	-0-	EPA & State grants
Action 3.2 Develop a priority system for allocation of grant monies for reclamation projects.	RWQCB	Dec. 1978		\$5,800	\$5,800	
Action 3.3 Construct cost-effective wastewater reclamation projects.	Wastewater agencies	Ongoing		\$10,200,000	-0-	EPA and State grants, user charges and revenue from sale of water

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
<u>Air Quality</u> <ul style="list-style-type: none"> o No impacts. <u>Water Quality and Quantity</u> <ul style="list-style-type: none"> o Relieves higher quality water supplies for more demanding purposes--e.g., potable supplies. o With reclamation, existing and proposed water supplies can serve greater population. <u>Physical Resources</u> <ul style="list-style-type: none"> o Reclaimed waters can be used to develop new agricultural lands. <u>Energy</u> <ul style="list-style-type: none"> o Energy is consumed in advanced treatment of wastewater for reclamation. o Energy needs for distribution of reclaimed water may be lower if alternative is importing water over large distances. <u>Amenities</u> <ul style="list-style-type: none"> o No impacts. 	<u>Financial</u> <ul style="list-style-type: none"> o See actions. <u>Institutional</u> <ul style="list-style-type: none"> o Requires cooperation of local, regional and state agencies. o Requires supportive regulations from State Health Department. 	<u>Production of Goods and Services</u> <p>Employment- Possible increase in employment as a result of development of markets for reclaimed water--certain increase in treatment plant operator employment.</p> <u>Income and Investment</u> <ul style="list-style-type: none"> o Increase in wages for those affected by employment increase. o Increase in income of some engineering firms. o Increased investments for water reclamation facilities and distribution systems. <u>Consumer Expenditures</u> <ul style="list-style-type: none"> o Increased availability of water supplies to agriculture and industry may keep production costs and consumer prices down. 	<u>Housing Supply</u> <ul style="list-style-type: none"> o Increased water supplies to agriculture and industry may release potable supplies for domestic use. o Increased potable supplies in water short areas might permit new housing starts. <u>Physical Mobility</u> <ul style="list-style-type: none"> o No impact. <u>Health and Safety</u> <ul style="list-style-type: none"> o No impacts if reclaimed water is adequately treated. <u>Sense of Community</u> <ul style="list-style-type: none"> o No impacts. <u>Equity</u> <ul style="list-style-type: none"> o No impacts. <u>Urban Patterns</u> <ul style="list-style-type: none"> o No impacts.
Impacts same as noted for Policy 3.	<u>Financial</u> <p>Direct Public Cost of Implementation</p> <ul style="list-style-type: none"> o (1978) \$2,000,000 o Matching funds requirement may cost the WMCC from \$500,000 to \$1 million. <p>Other institutional impacts are the same as noted for Policy 3.</p>	<u>Production of Goods and Services</u> <p>Employment - Some study funds will be passed to local water supply agencies or private consulting firms benefitting employment in those areas and for the WMCC staff.</p> <p>Other economic impacts are the same as noted for Policy 3.</p>	Impacts same as noted for Policy 3.
Impacts same as noted for Policy 3.	<u>Financial</u> <p>Direct Public Cost of Implementation</p> <ul style="list-style-type: none"> o (1978) \$15,000 o (1979-2000) \$5,000/year <u>Institutional</u> <ul style="list-style-type: none"> o If grant funds become limited-worth project without reclamation features might not be funded to fullest extent. 	Impacts same as noted for Policy 3.	Impacts same as noted for Policy 3.
Impacts same as noted for Policy 3.	<u>Financial</u> <p>Direct Public Cost of Implementation</p> <ul style="list-style-type: none"> o (1977-2000) \$133,140,000 (estimate of construction costs expended by the year 2000) o (2000) \$5,330,000/year (estimated operating and maintenance cost in the year 2000 when all projects are built) 	Impacts same as noted for Policy 3.	Impacts same as noted for Policy 3.

Costs and benefits of the plan

The principal benefit of this plan is that it's implementation will lead toward optimal use of the water supplies available to the Bay Area. Optimal use, in this case, might be defined as the type of use that results in the least total cost to the region. Total cost includes monetary, environmental and social costs.

If we use the water we already have efficiently, we will then minimize the need to develop new sources, usually an expensive and environmentally damaging proposition. If we build new systems we don't really need we will have to live with unnecessary monetary and environmental costs. On the other hand if we build insufficient new systems we will be severely hurt during dry spells.

The key issue is an environmental one. The cost of water is only a small part of an individual homeowner or a business's budget. Provision of excess water supply capacity at a slightly higher cost to avoid even slight discomfort during a drought might be regarded as good insurance. The tradeoff is between retaining a river in its natural state and the degree of assurance of adequate water supply we might have in a drought.

The direct environmental effects of the residential water savings programs recommended in the plan are almost negligible. Construction of the wastewater reclamation projects recommended will have certain short-term adverse environmental effects such as increased dust and noise in the vicinity of construction activities.

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